

C4297 Log Data Report

Borehole Information:

Borehole: C4297		Site: 241-C-105			
Coordinates (Hanford Plant)		GWL (ft)¹: Dry		GWL Date: 03/23/04	
North 42819.84 ft	West 48359.79	Drill Date 03/04	Ground Level Elevation Not Available	Total Depth (ft) 196.5	Type Percussion

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	0.7	10 3/4	9 3/4	1/2	0	152.09
Threaded Steel	3.7	8 5/8	7 5/8	1/2	0	195.58

Borehole Notes:

Casing, drilling, and groundwater information were provided by the driller. The casing thickness of 0.5 in. was confirmed by e-mail from David Myers of CH2M HILL. The coordinates were also provided by CH2M HILL. Logging data acquisition is referenced to the ground surface.

Logging Equipment Information:

Logging System: Gamma 1E	Type: SGLS (70%) SN: 34TP40587A
Calibration Date: 01/04	Calibration Reference: GJO-2004-568-TAC
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Logging System: Gamma 2A	Type: SGLS (35%)
Calibration Date: 03/04	Calibration Reference: Not yet available
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Logging System: Gamma 2F	Type: NMLS (SN: H380932510)
Calibration Date: 09/03	Calibration Reference: GJO-2003-520-TAC
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	3	4	5 Repeat	6	7
Date	03/03/04	03/03/04	03/03/04	03/19/04	03/19/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	149.43	149.0	50.0	194.62	194.0

Log Run	3	4	5 Repeat	6	7
Finish Depth (ft)	149.93	0.0	35.0	194.62	145.0
Count Time (sec)	100	100	100	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	None	1	1	None	1
ft/min	N/A ²	N/A	N/A	N/A	N/A
Pre-Verification	AE098CAB	AE098CAB	AE098CAB	BA317CAB	BA317CAB
Start File	AE098000	AE098001	AE098151	BA317000	BA317001
Finish File	AE098000	AE098150	AE098166	BA317000	BA317050
Post-Verification	AE098CAA	AE098CAA	AE098CAA	BA317CAA	BA317CAA
Depth Return Error (in.)	N/A	-1	0	N/A	N/A
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	Fine-gain adjustment after: BA317003, -010, -022.

Log Run	8 Repeat				
Date	03/19/04				
Logging Engineer	Spatz				
Start Depth (ft)	160.0				
Finish Depth (ft)	155.0				
Count Time (sec)	200				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1				
ft/min	N/A				
Pre-Verification	BA317CAB				
Start File	BA317051				
Finish File	BA317056				
Post-Verification	BA317CAA				
Depth Return Error (in.)	-0.25				
Comments	No fine-gain adjustment.				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2 Repeat	9	10 Repeat	
Date	03/02/04	03/02/04	03/23/04	03/23/04	
Logging Engineer	Spatz	Spatz	Pearson	Pearson	
Start Depth (ft)	0.0	80.0	145.0	157.0	
Finish Depth (ft)	95.0	149.25	194.5	162.0	
Count Time (sec)	N/A	N/A	N/A	N/A	
Live/Real	N/A	N/A	N/A	N/A	
Shield (Y/N)	N/A	N/A	N/A	N/A	
Sample Interval (ft)	0.25	0.25	0.25	0.25	
ft/min	1.0	1.0	1.0	1.0	
Pre-Verification	BF161CAB	BF161CAB	BF162CAB	BF162CAB	
Start File	BF161000	BF161381	BF162000	BF162199	
Finish File	BF161380	BF161658	BF162198	BF162219	
Post-Verification	BF161CAA	BF161CAA	BF162CAA	BF162CAA	
Depth Return Error (in.)	N/A	+0.5	N/A	+.05	
Comments	No fine-gain adjustment.	Repeat 80-95 ft.	No fine-gain adjustment.	No fine-gain adjustment.	

Logging Operation Notes:

Spectral gamma and moisture logging were performed in this borehole during March 2004 on four separate days. SGLS G1E was used for logging runs 3, 4, and 5 and G2A for log runs 6, 7, and 8. Logging was conducted with a centralizer on the sonde. Logging measurements are referenced to ground surface. Repeat sections were collected in this borehole to evaluate system performance.

Analysis Notes:

Analyst:	Henwood	Date:	03/30/04	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for each logging system were performed for each day's log event. The acceptance criteria were met for all logging systems.

A casing correction for 0.5-in.-thick casing was applied for the steel casing to the total depth of the borehole. The 0.5-in. casing wall thickness is provided by CH2M HILL.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G2AFeb04.xls and G1EJan04.xls for the SGLSs, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 10.5 percent. Where SGLS dead time exceeds 40 percent, pulse pileup and peak spreading may occur in a spectrum that results in an underestimation of the concentration of man-made radionuclides. Dead time of 40 percent was exceeded in two depth intervals (13 and 14 ft). Because the interval of high dead time was thin, it was determined the HRLS could not be efficiently deployed to obtain data. No correction for water was necessary in this borehole.

NMLS log spectra were processed in batch mode using APTEC Supervisor to determine count rates. The volume fraction of water was not calculated because there is no valid calibration for a 10-in.-diameter borehole. However, increasing count rates are a reliable indicator of increasing moisture content.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs , ^{154}Eu , and ^{60}Co) detected in the borehole, naturally occurring radionuclides (^{40}K , ^{238}U , ^{232}Th [KUT]), a combination of man-made, KUT, and moisture, and total gamma plotted with dead time. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections are also included.

Results and Interpretations:

^{137}Cs , ^{154}Eu , and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected between the ground surface and 19 ft in depth at concentrations between 0.3 and 1,700 pCi/g. ^{137}Cs was also detected at a few locations near its MDL of approximately 0.2 pCi/g.

^{60}Co was detected at 12 and 15 ft and between 40 ft and 65 ft. The maximum concentration measured was approximately 1 pCi/g at 15 ft.

^{154}Eu was detected between 11 and 16 ft. The maximum concentration measured was approximately 400 pCi/g at 13 ft.

The profile of the ^{137}Cs , ^{154}Eu , and ^{60}Co between approximately 11 and 16 ft is suggestive of a point source of contamination such as a pipeline. A 3-in. inlet line #V103 that connects to the southwest quadrant of tank C-105 lies a few feet northeast from the location of the borehole at a depth of 13.63 ft below grade. It is hypothesized that the log data reflect contamination inside this pipeline.

Recognizable changes in the KUT and total gamma logs occurred in this borehole. At 39 ft, there is a 3-pCi/g increase in ^{40}K concentration and a decrease in relative moisture content. This increase in apparent ^{40}K concentration corresponds with the base of the backfill. An interval between 40 and 65 ft appears to reflect alternating layers and mixtures of sand and gravel that coincide with the ^{60}Co contamination. At 65 ft the ^{40}K concentrations increase about 5 pCi/g and a thin fine-grained sediment layer exists where relatively higher moisture content is shown. The downward movement of the ^{60}Co is apparently retarded by this layer. Another thin sediment layer is shown at 75 ft by an increase in ^{40}K , ^{232}Th , and moisture. Between 130 and 135 ft increases in KUT and moisture are exhibited.

Log runs 3, 4, and 5 conducted March 3, 2004 show indications of enhanced radon as reflected by a slightly elevated naturally occurring ^{238}U concentration between the ground surface and 150 ft in depth. Where the casing size change occurs at approximately 150 ft, the moisture shows an increase in count rate. This increase in count rate is the result of a change from 10-in. to 8-in. casing and probably not a significant difference in moisture content.

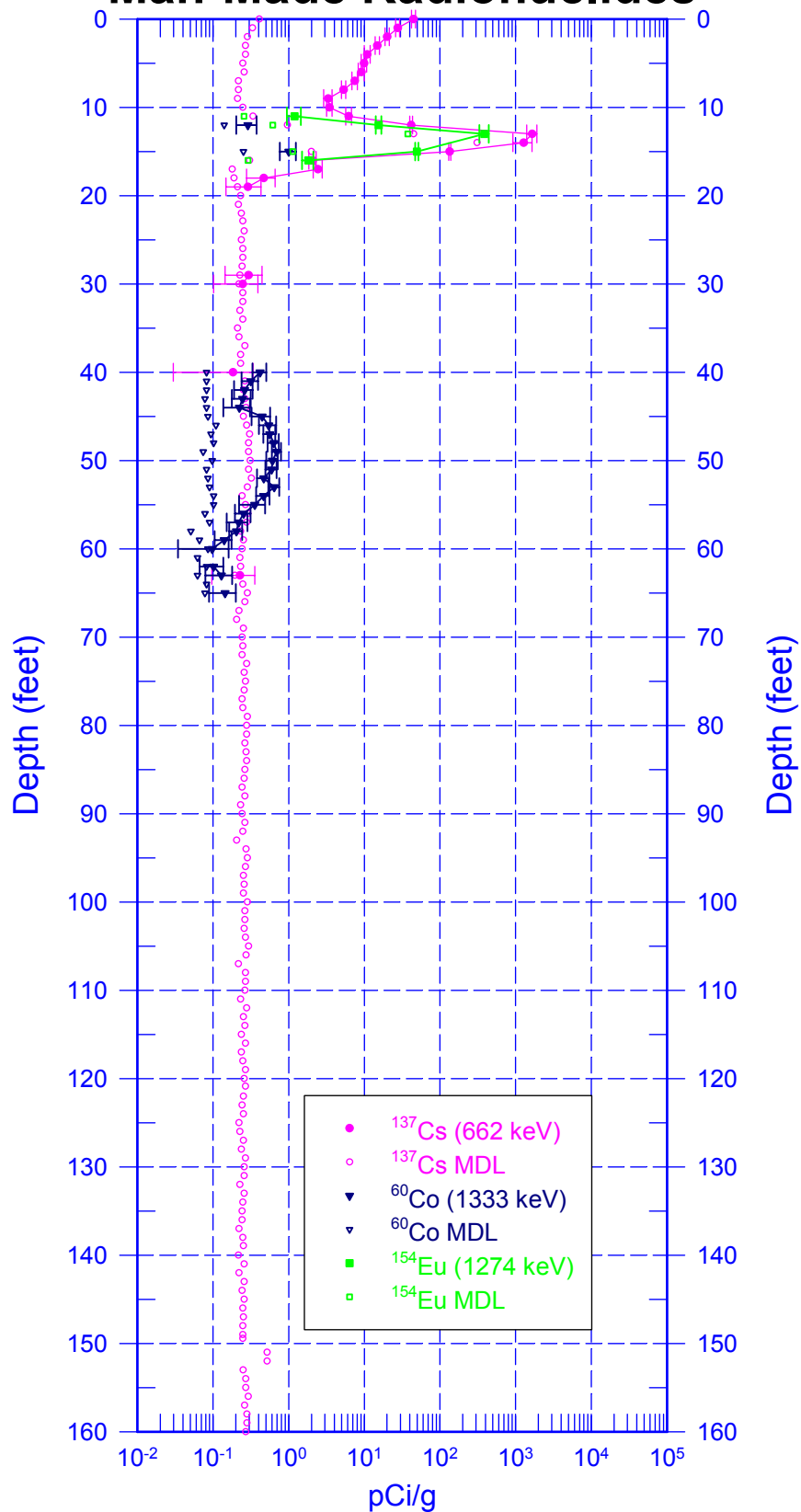
The repeat sections indicated good agreement of the man-made radionuclides, naturally occurring KUT, and moisture.

¹ GWL – groundwater level

² N/A – not applicable

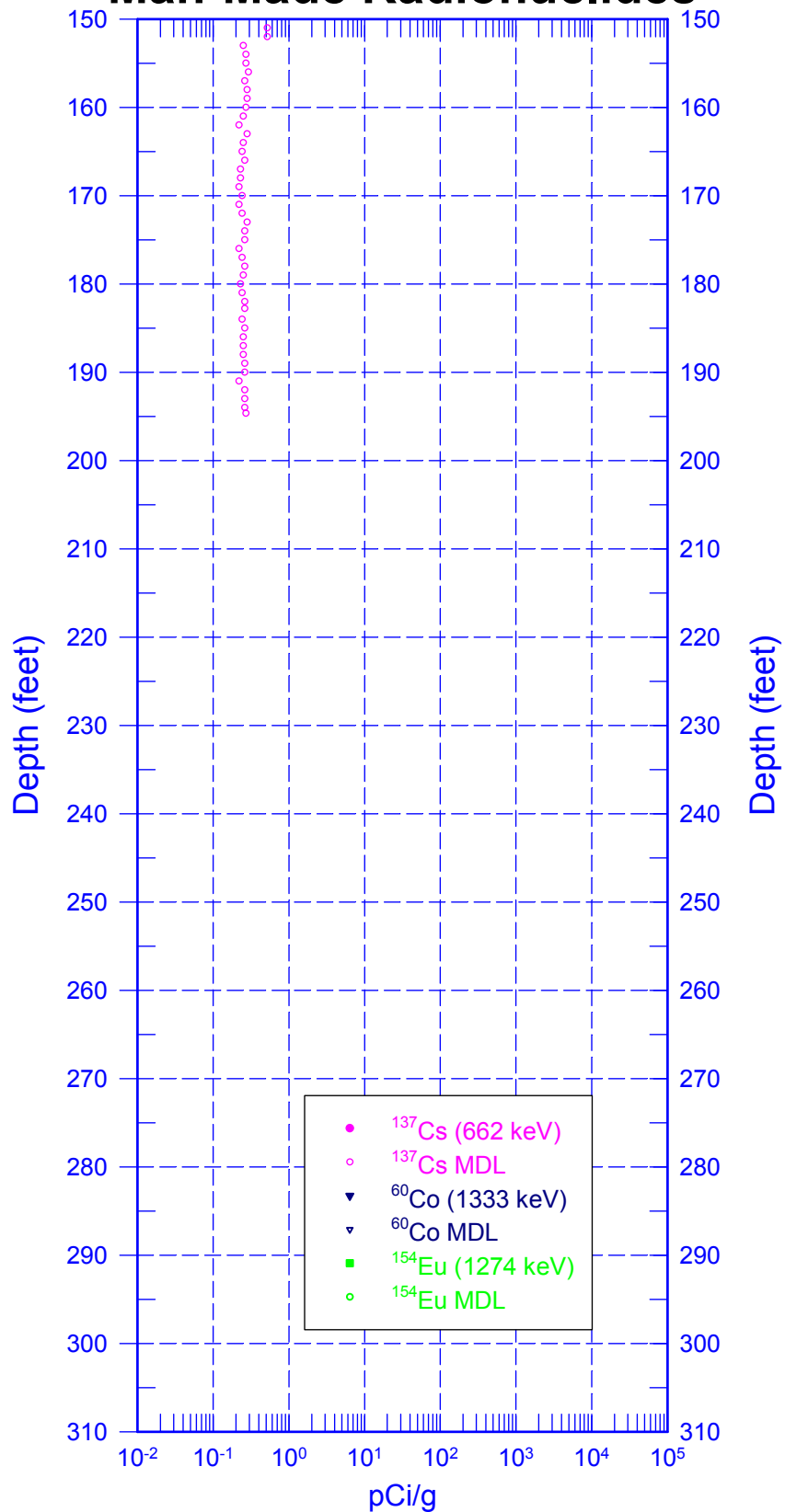
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Man-Made Radionuclides



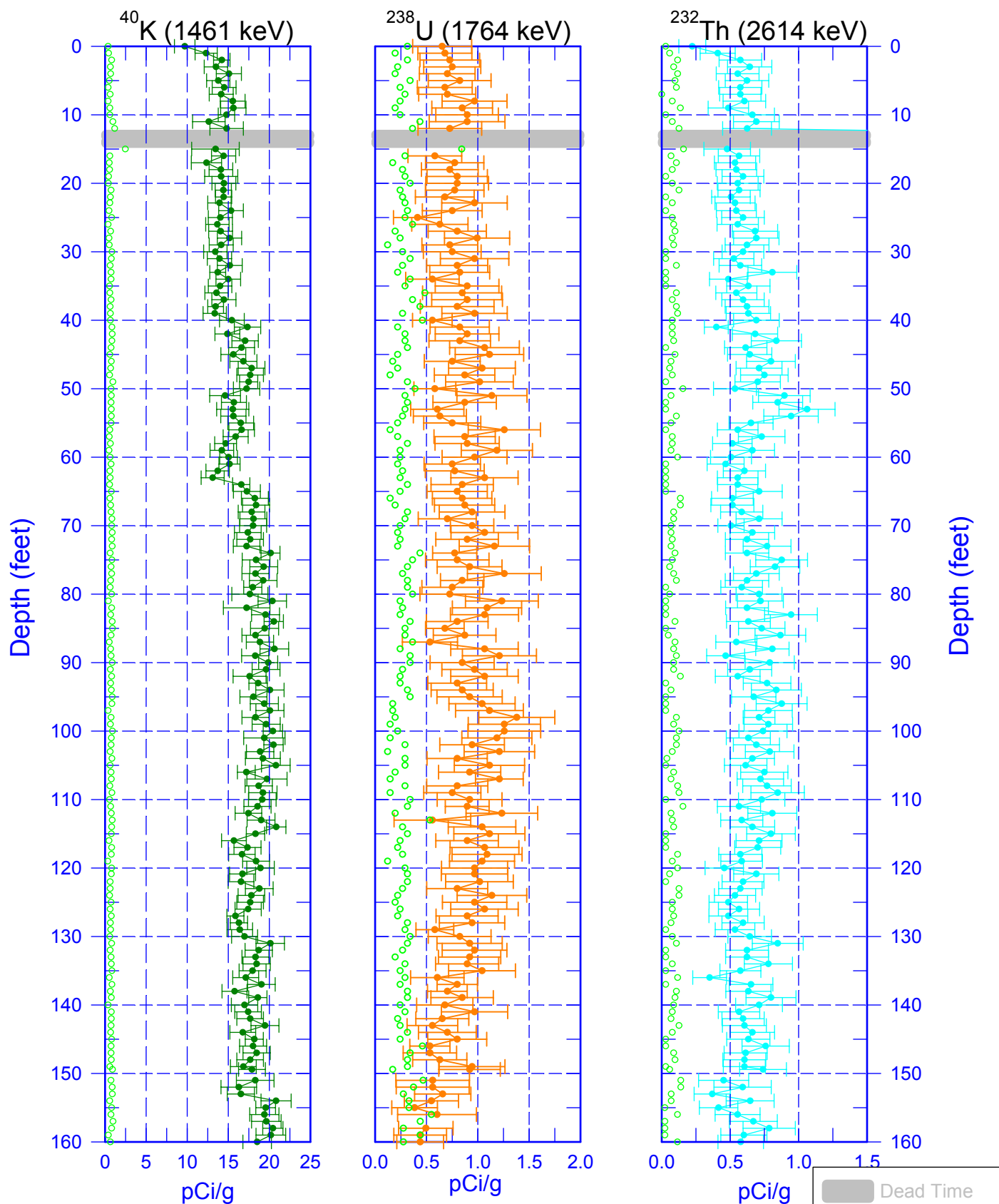
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Man-Made Radionuclides



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Natural Gamma Logs



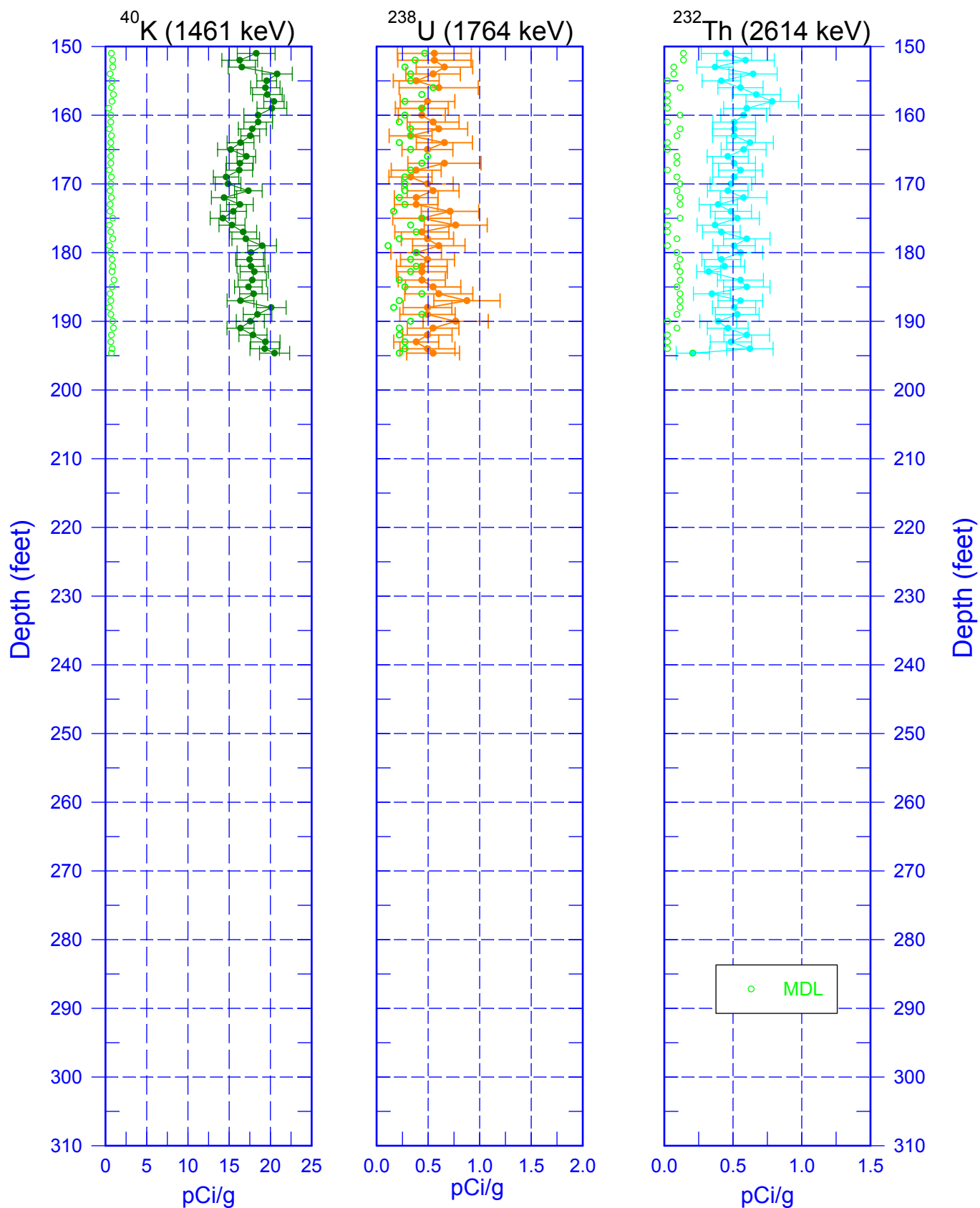
Zero Reference = Ground Surface

Depth scale: 1" = 20 ft

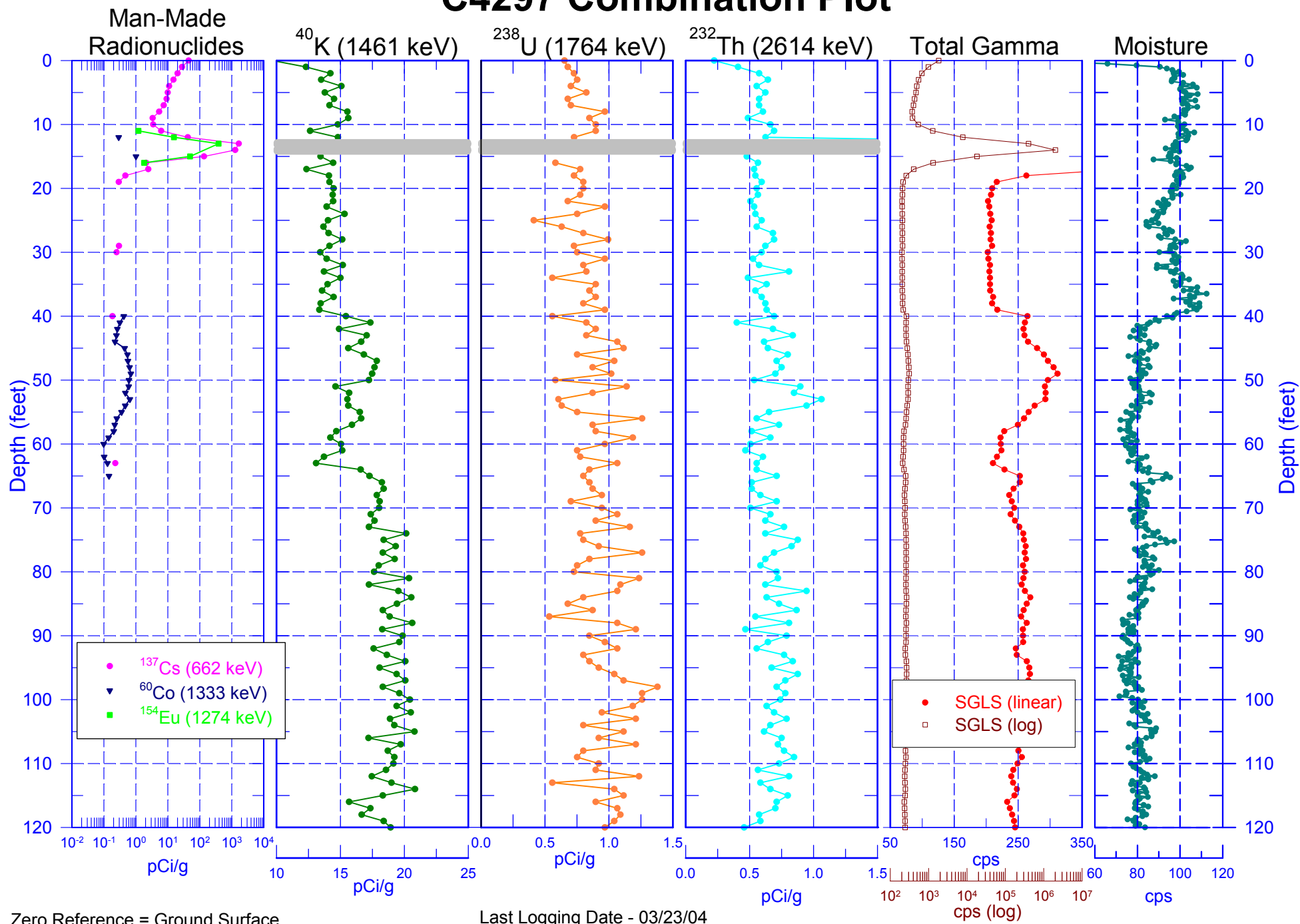
Last Log Date - 03/23/04

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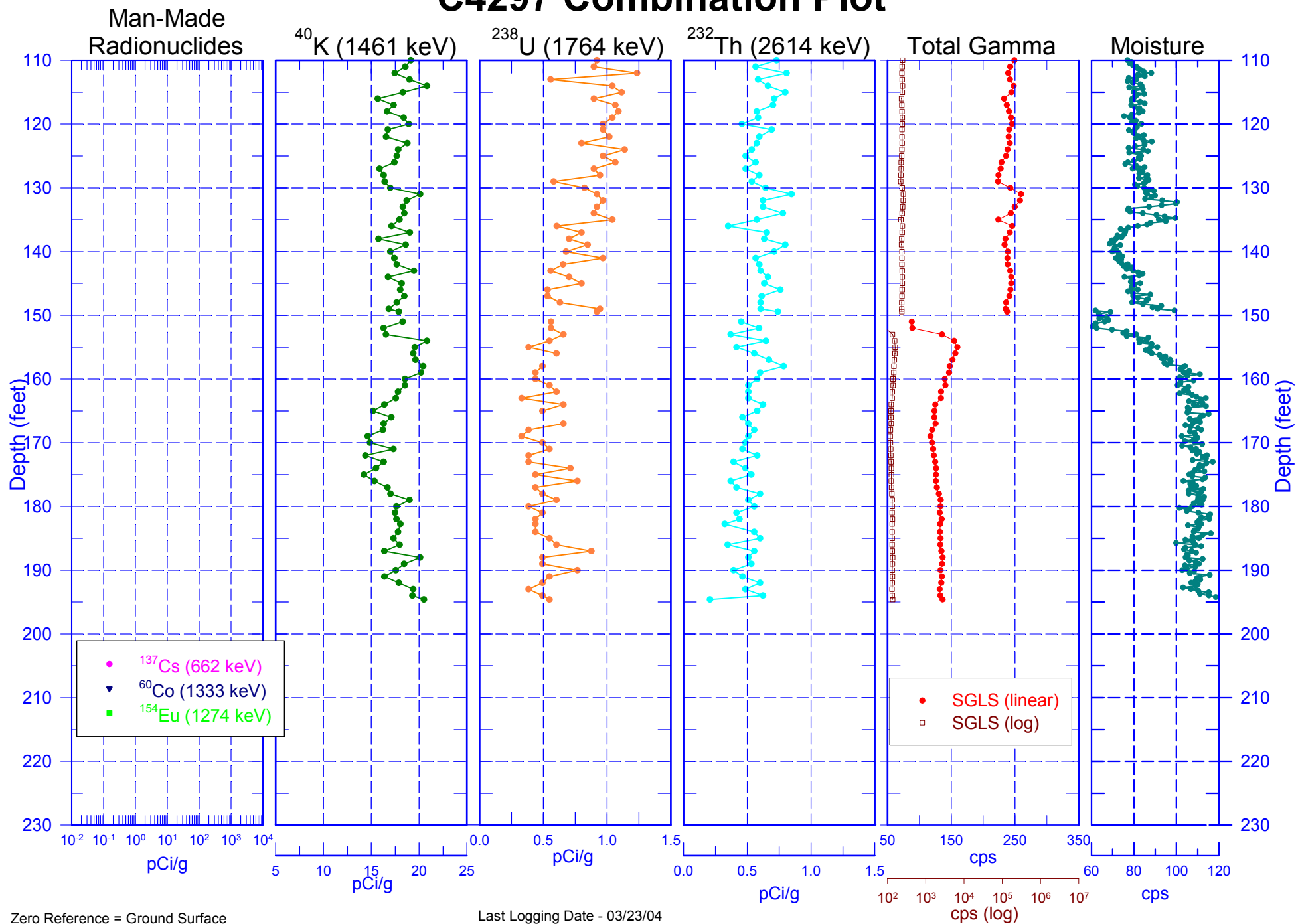
Natural Gamma Logs



C4297 Combination Plot

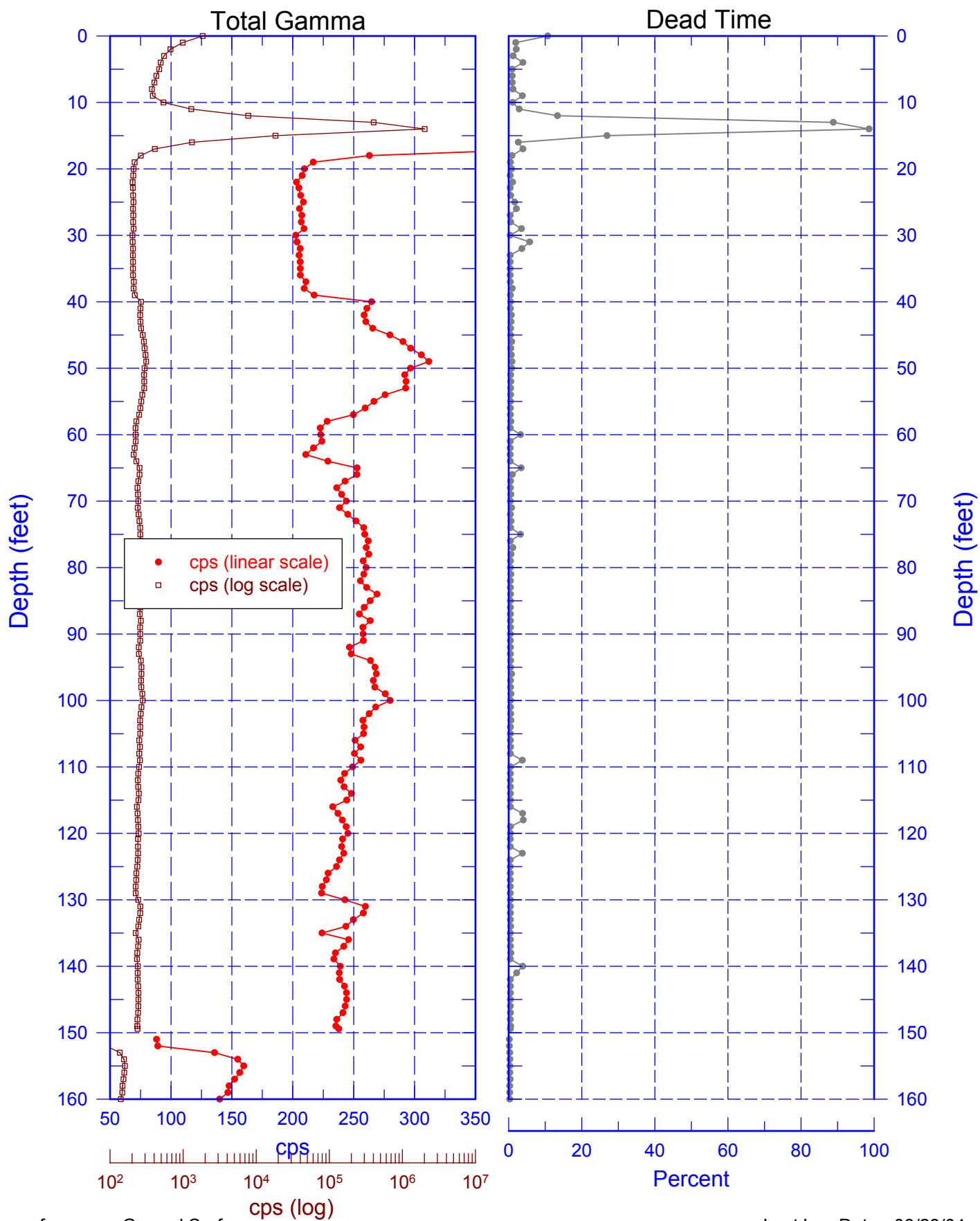


C4297 Combination Plot



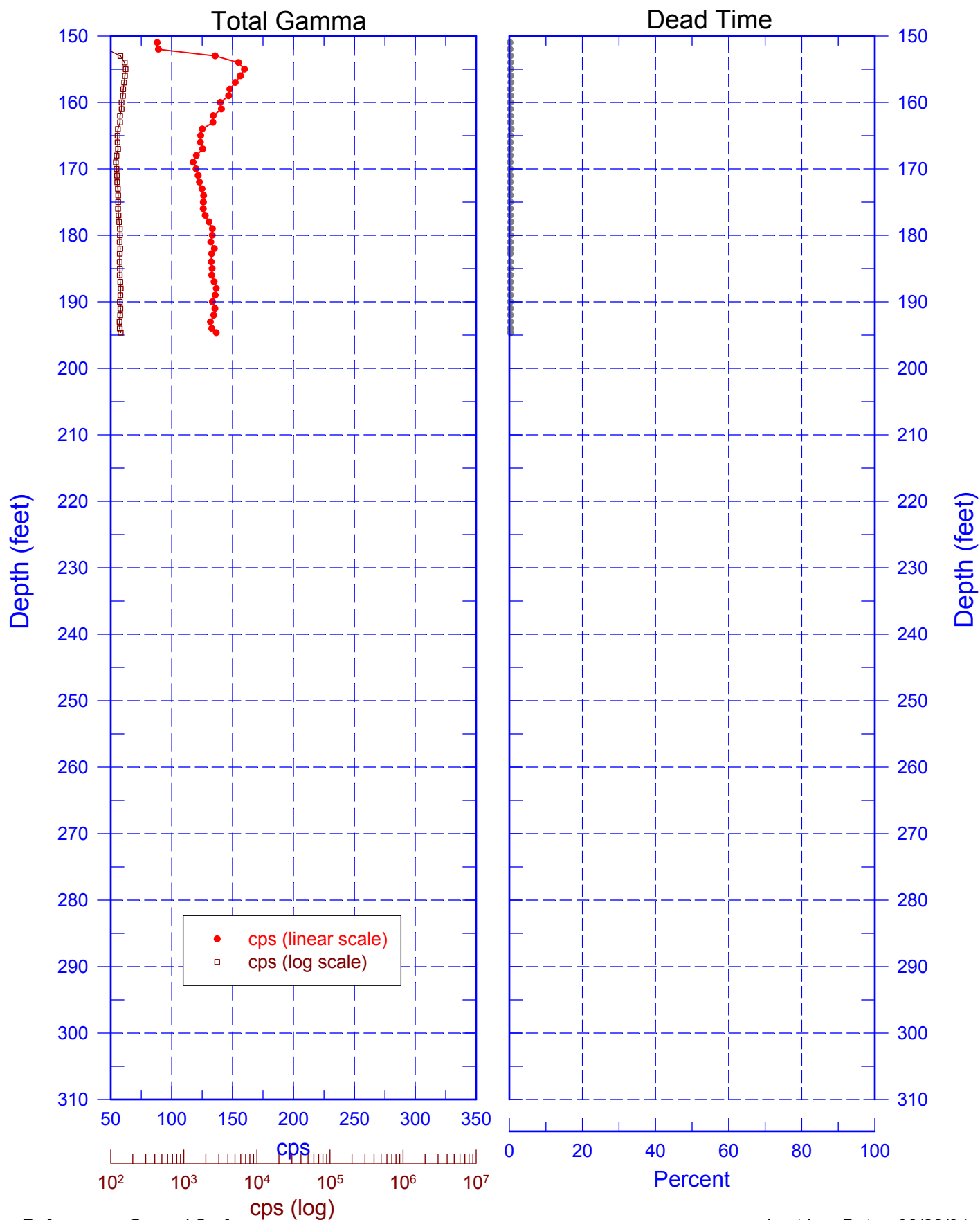
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Total Gamma & Dead Time



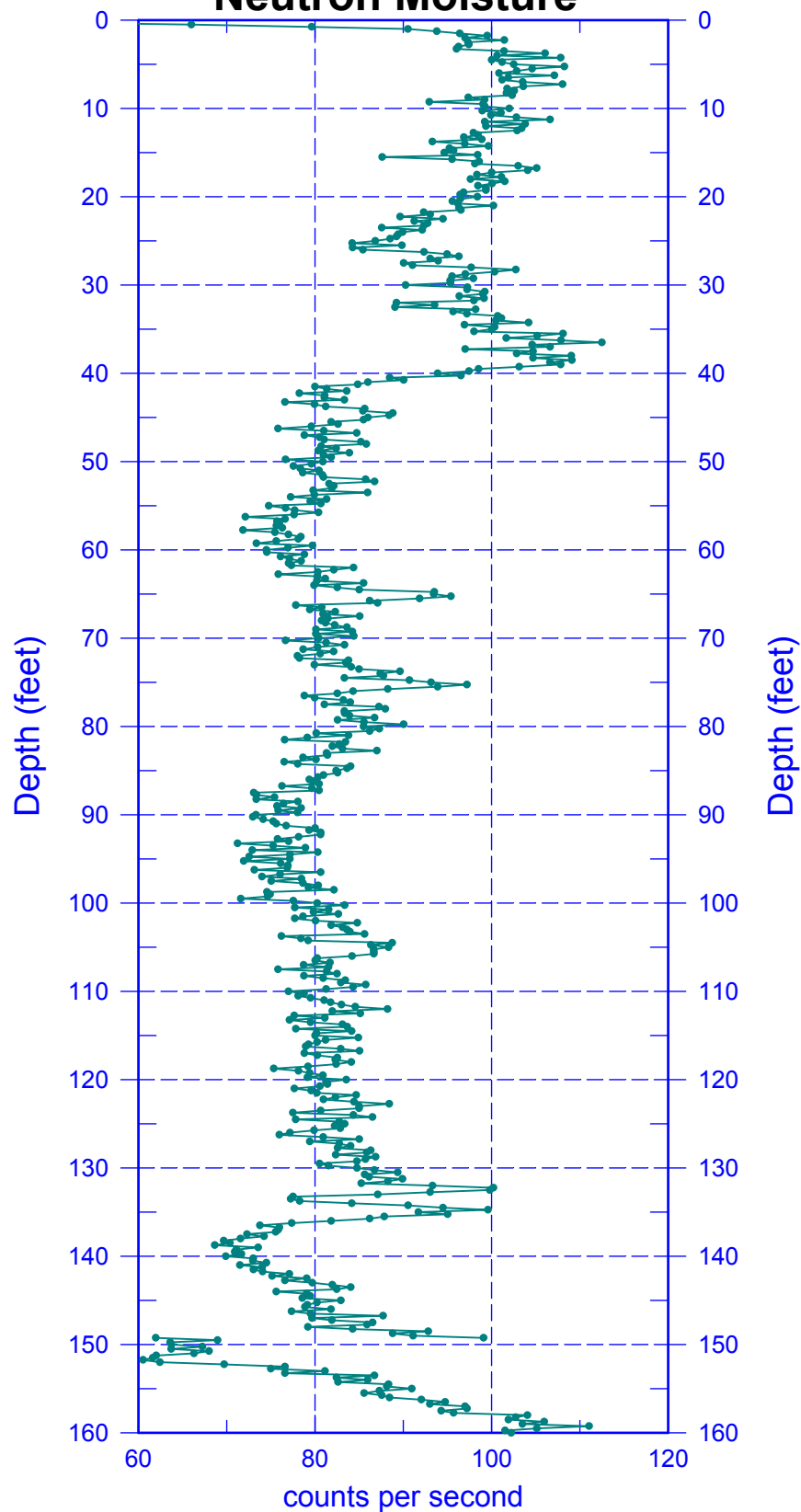
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Total Gamma & Dead Time



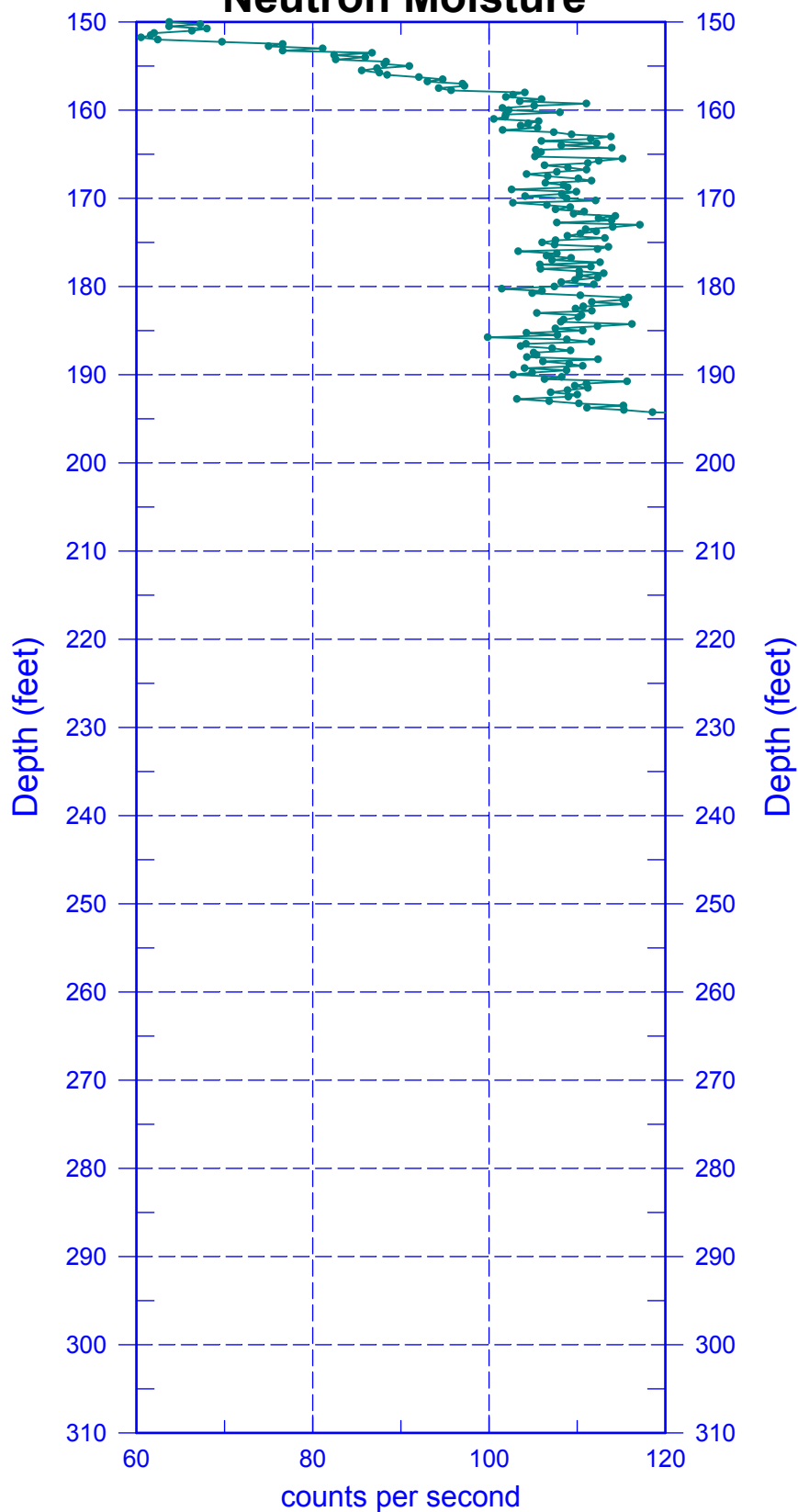
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Neutron Moisture



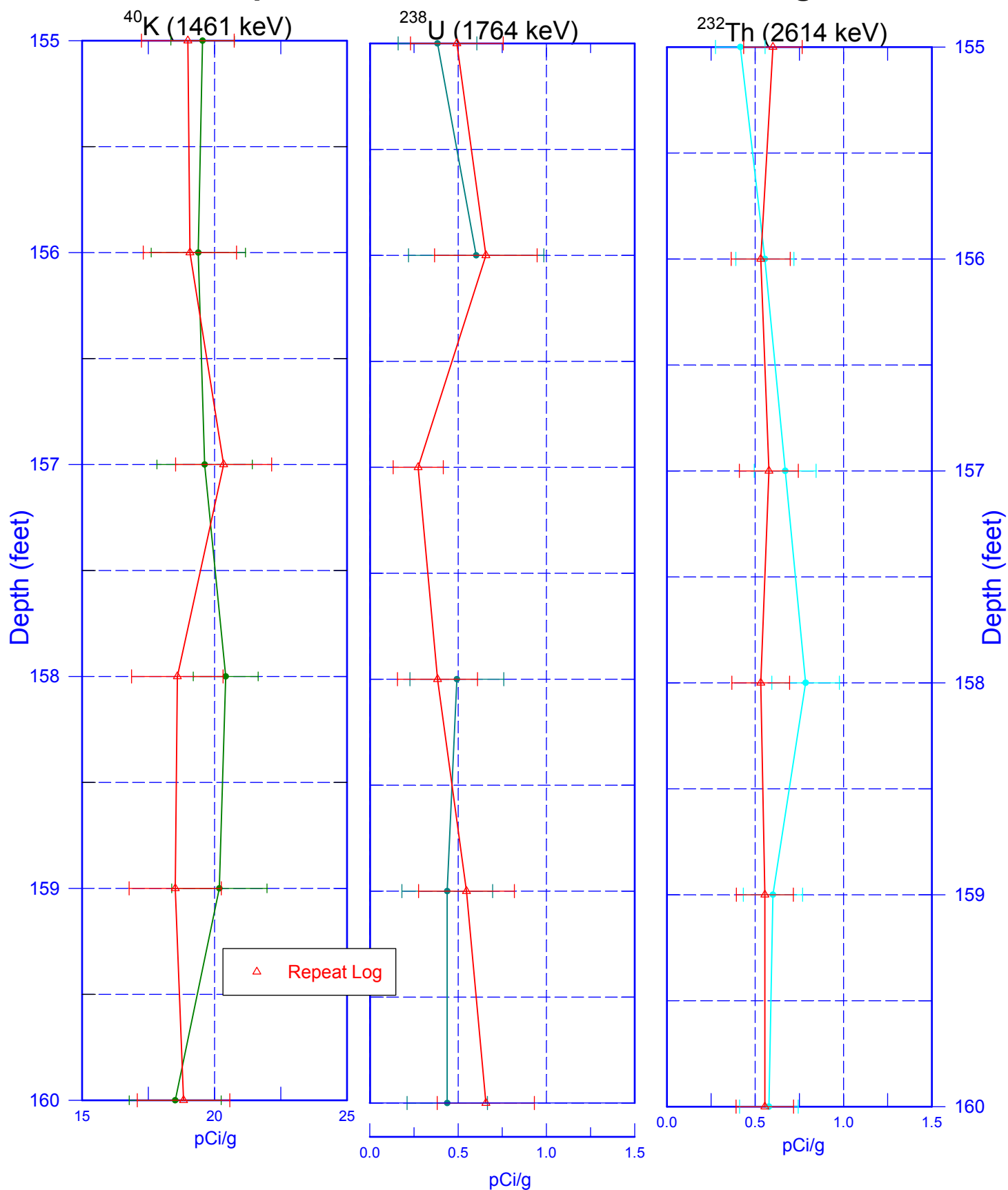
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Neutron Moisture



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Repeat Section of Natural Gamma Logs

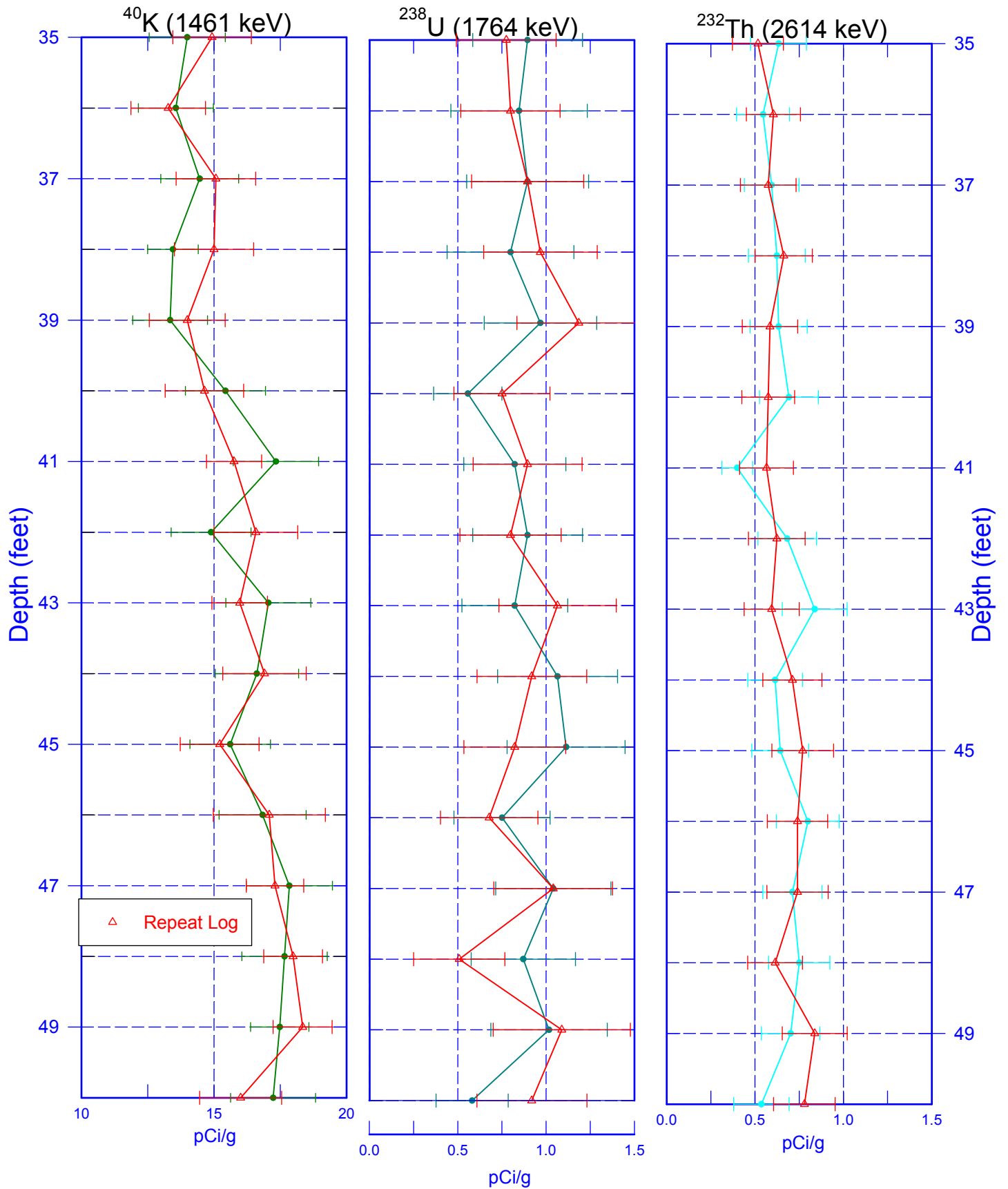


Zero Reference = Ground Surface

Last Log Date - 03/23/04

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Repeat Section of Natural Gamma Logs

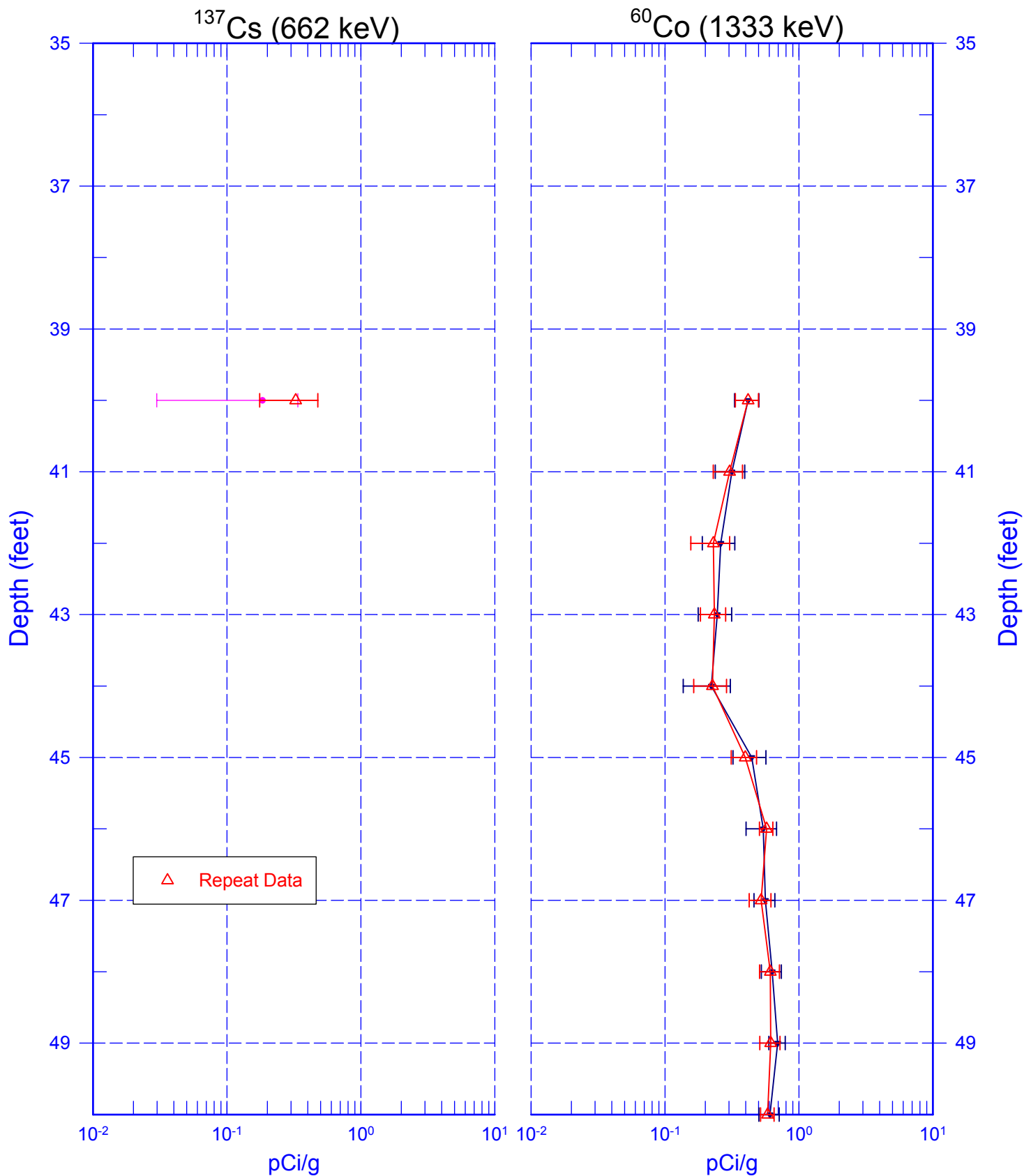


Zero Reference = Ground Surface

Last Log Date - 03/23/04

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Repeat Section of Man-Made Radionuclides



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Moisture Repeat Sections

